Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

Claim 1. (Currently Amended) A method of compensating for a frequency offset between a transmission signal and a reception signal for a u^{th} user ($1 \leq u \leq U$, where U denotes the number of users) in an interleaved frequency division multiple access (IFDMA) system, the method comprising the steps of:

(a) estimating the frequency offset from a selection signal in the IFDMA system that is determined as the reception signal for the u^{th} user in an initial mode and as a feedback signal in a normal mode;

(b) estimating multiple access interferences representing an extent to which reception signals for i^{th} other users ($1 \leq i \leq U-1$) at the same time interfere with the reception signal for the u^{th} user;

(c) subtracting the estimated multiple access interferences from the reception signal for the u^{th} user and determining the subtraction result as the feedback signal;

(d) determining whether steps (a), (b), and (c) have been repeated a predetermined number of times, and if it is determined that steps (a), (b), and (c) have not been repeated the predetermined number of times, going back to step (a); and

(e) if it is determined that steps (a), (b), and (c) have been repeated the predetermined number of times, estimating the transmission signal for the u^{th} user using the feedback signal finally determined in step (c) and the estimated frequency offset.

Claim 2. (Original) The method of claim 1, wherein in step (a), the frequency offset is estimated from the selection signal using the following equation:

$$\hat{\varepsilon}_u = \frac{\angle C_u}{2\pi}$$

where $\widehat{\varepsilon_u}$ denotes the frequency offset, $|\widehat{\varepsilon_u}| < \frac{1}{2}$, $\angle C_u$, , denotes the angle of a correlation value $\sum_{k=1}^{N_u-1} \widehat{z_{k+N}^{(u)[u]}} (\widehat{z_k^{(u)[u]}})^*$, N_u denotes the number of carriers used by the u^{th} user, k (k=0, 1, …, and N_u-1) denotes the order of the reception signal for the u^{th} user among a plurality of signals contained in a frame, $\widehat{z_k^{(u)[u]}}$ denotes the selection signal, N denotes the number of chips constituting a block, $\widehat{z_{k+N}^{(u)[u]}}$ denotes the result obtained by delaying the selection signal $\widehat{z_k^{(u)[u]}}$ by N, and $(\widehat{z_k^{(u)[u]}})^*$ denotes a conjugate of the selection signal $\widehat{z_k^{(u)[u]}}$.

Claim 3. (Original) The method of claim 2, wherein in step (b), the extent $\widehat{z_k^{(i)[u]}}$ to which the i^{th} other user among other users interfere with the u^{th} user is estimated using the following equation:

$$\widehat{z_k^{(i)[u]}} = \begin{cases} e^{j\pi[\Delta_{iu}(2k/N-1/L_u)+\widehat{\varepsilon_i}(1/L_i-1/L_u)]} \dfrac{q_i \sin(\pi \widehat{\varepsilon_i}/L_i)}{L_i \sin[\pi(\Delta_{iu}+\widehat{\varepsilon_i})/L_u]} \cdot \widehat{z_{k\%N_i}^{(i)[i]}}, & \text{for } N_i \le N_u \\ e^{j\pi[\Delta_{iu}(2k/N-1/L_i)]} \dfrac{q_i \sin(\pi \widehat{\varepsilon_i}/L_i)}{L_i \sin[\pi(\Delta_{iu}+\widehat{\varepsilon_i})/L_i]} \cdot \sum_{l=0}^{M_{iu}-1} e^{j2\pi(\Delta_{iu}+\widehat{\varepsilon_i})l/L_u} \widehat{z_{k+lN_u}^{(i)[i]}}, & \text{for } N_i > N_u \end{cases}$$

where $k\%N_i$ denotes the remainder when k is divided by N_i, N_i denotes the number of carriers used by the i^{th} user, L_i denotes the number of times user symbols are repeated in a transmitter for the i^{th} user, L_u denotes the number of times user symbols are repeated in a transmitter for the u^{th} user, Δ_{iu} denotes n_i-n_u, n_i denotes a frequency offset assigned to the

i^{th} user, n_u denotes a frequency offset assigned to the u^{th} user, q_i denotes an initial phase offset in an i^{th} block, and $M_{iu} = \dfrac{N_i}{N_u} = \dfrac{L_u}{L_i}$.

Claim 4. (Original) The method of claim 3, wherein in step (c), the estimated interference $\sum_{i=1, i \neq u}^{U} \widehat{z_k^{(i)[\tilde{u}]}}$ is subtracted from the reception signal for the u^{th} user using the following equation:

$$\widehat{z_k^{(u)[\tilde{u}]}} = r_k^{[u]} - \sum_{i=1, i \neq u}^{U} \widehat{z_k^{(i)[\tilde{u}]}}$$

where $\widehat{z_k^{(u)[\tilde{u}]}}$ is the feedback signal and $r_k^{[u]}$ denotes the reception signal for the u^{th} user.

Claim 5. (Original) The method of claim 4, wherein the predetermined number of times is determined in proportion to a rate by which a signal-to-noise ratio decreases.

Claim 6. (Original) The method of claim 5, wherein in step (e), if it is determined that steps (a), (b), and (c) have been repeated the predetermined number of times, the transmission signal $y_k^{[u]}$ for the u^{th} user is estimated using the feedback signal $\widehat{z_k^{(u)[\tilde{u}]}}$ finally determined in step (c) and the estimated frequency offset $\widehat{\varepsilon_u}$ according to the following equation:

$$\widehat{y_k^{[\tilde{u}]}} = e^{-j\pi[\Delta_u(2k/N - 1/L_u)+1]} \frac{L_u \sin(\pi \hat{\varepsilon}_u / L_u)}{\hat{q}_u \sin(\pi \hat{\varepsilon}_u)} \widehat{z_k^{(u)[\tilde{u}]}}$$

where $y_k^{[u]}$ denotes the estimated transmission signal for the u^{th} user and q_u denotes an initial phase offset in an u^{th} block.

Claim 7. (Currently Amended) An apparatus for compensating for a frequency offset between a transmission signal and a reception signal for an u^{th} user ($1 \leq u \leq U$, where U denotes the number of users) in an interleaved frequency division multiple access (IFDMA) system, the apparatus comprising:

a main frequency offset estimator for determining the reception signal for the u^{th} user or a feedback signal as a selection signal in response to a first control signal in the IFDMA system, estimating the frequency offset from the selection signal, and outputting the estimated frequency offset;

an extent estimator for estimating multiple access interferences representing an extent to which reception signals for from i^{th} other users ($1 \leq i \leq U-1$) interfere with the reception signal for the u^{th} user, from the reception signals for the i^{th} other users, the selection signal, and the estimated frequency offset, and ~~outputing~~ outputting the estimated multiple access interferences;

a subtractor for subtracting the estimated interferences from the reception signal for the u^{th} user and outputting the subtraction result as the feedback signal;

a controller for generating the first control signal in response to the result obtained by analyzing the state of the apparatus for compensating for the frequency offset, checking whether a predetermined period of time has elapsed, and outputting a second control signal in response to the checked result; and

a transmission signal estimator for estimating the transmission signal for the u^{th} user from the feedback signal finally input from the subtractor and the estimated frequency offset in response to the second control signal and outputting the estimated transmission signal,

wherein the main frequency offset estimator, the extent estimator, and the subtractor are enabled in response to the second control signal.

Claim 8. (Original) The apparatus of claim 7, wherein the main frequency offset estimator comprises:

a first selector for selecting one of the feedback signals input from the subtractor and the reception signal for the u^{th} user input from the outside in response to the first control signal and outputting the selection result as the selection signal;

a first delayer for delays the selection signal input from the first selector by a unit block and outputting the delayed selection signal;

a first conjugate calculator for calculating a conjugate of the selection signal input from the first selector and outputting the calculated conjugate of the selection signal;

a first multiplier for multiplying the conjugate of the selection signal input from the first conjugating calculator by the delayed selection signal input from the first delayer and outputting the multiplication result; and

a first offset calculator for accumulating the multiplication result input from the first multiplier by N_u-1 that is one less than the number N_u of carriers used by the u^{th} user, calculating an angle of the accumulation result, divides the angle by a predetermined number, and outputting the division result as the estimated frequency offset,

wherein the first selector, the first delayer, the first conjugate calculator, the first multiplier, and the first frequency offset are enabled in response to the second control signal.

Claim 9. (Original) The apparatus of claim 8, wherein the transmission signal estimator comprises:

a first gain calculator for calculating a gain from the estimated frequency offset input from the main frequency offset estimator using equation below and outputting the calculation result as a first gain:

$$-e^{-j\pi[\Delta_{u}(2k/N-1/L_u)+1]}\frac{L_u\sin(\pi\,\hat{\varepsilon}_u/L_u)}{q_u\sin(\pi\hat{\varepsilon}_u)}$$

where k (k=0, 1, …, and N_u-1) denotes the order of the corresponding reception signal for the u^{th} user among a plurality of reception signals contained in a frame, N denotes the

number of chips constituting a block, L_u denotes the number of times user symbols are repeated in a transmitter for the u^{th} user, $\widehat{\varepsilon_u}$ denotes the frequency offset for the u^{th} user, Δ_{iu} denotes n_i-n_u, n_i denotes a frequency offset assigned to the i^{th} user, n_u denotes a frequency offset assigned to the u^{th} user, and q_u denotes an initial phase offset in an u^{th} block;

an inverter for inverting the first gain; and

a second multiplier for multiplying the feedback signal finally input from the subtractor by the inverted first gain and outputting the multiplication result as the estimated transmission signal,

wherein the first gain calculator, the inverter, and the second multiplier are enabled in response to the second control signal.

Claim 10. (Original) The apparatus of claim 9, wherein the extent estimator comprises:

first through U-1^{th} sub frequency offset estimators;

first through U-1^{th} extent estimators that estimate the first through U-1^{th} interferences;

an adder; and

a feedback signal generator,

wherein the i^{th} sub frequency offset estimator selects the feedback signal for the i^{th} user or the reception signal for the i^{th} other user in response to the first control signal and then estimates a frequency offset for the i^{th} other user from the selection result, the i^{th} extent estimator estimates the i^{th} interference corresponding to the extent to which the reception signal for the i^{th} other user interfere with the reception signal for the u^{th} user, from the frequency offset for the i^{th} other user and the selection result selected by the i^{th} sub frequency offset estimator, the adder adds the first through U-1^{th} interferences and then outputs the addition result as the interference, and the feedback signal generator generates feedback signals used in the first through U-1^{th} sub frequency offset estimators

from the first gain, the selection signal, the first through U-1th interferences, and the reception signals for the other users.

Claim 11. (Original) The apparatus of claim 10, wherein the ith sub frequency offset estimator comprises:

a second selector for selecting one of the feedback signal for the ith other user and the reception signal for the ith other user input from the outside in response to the first control signal and outputting the selection result;

a second delayer for delays the selection result input from the second selector by the unit block and then outputting the delayed result;

a second conjugate calculator for calculating a conjugate of the selection result input from the second selector and then outputting the calculation result;

a third multiplier for multiplying the calculation result input from the second conjugate calculator by the delayed result input from the second delayer and then outputting the multiplication result; and

a second offset calculator for accumulating the multiplication result input from the third multiplier by N_i-1 that is one less than the number N_i of carriers used by the ith other user, calculating an angle of the accumulation result, dividing the angle by a predetermined number, and outputting the division result as the estimated frequency offset for the ith other user.

Claim 12. (Original) The apparatus of claim 10, wherein the ith extent estimator comprises:

a comparator for comparing the number N_u of subcarriers used by the uth user with the number N_i of subcarriers used by the ith other user and then outputting the comparison result;

a signal expander and reducer for expanding or reducing the length of the selection result $\widehat{z_k^{(i)[1]}}$ input from the second selector in response to the comparison result

input from the comparator according to equation below and then outputting the expansion or reduction result:

$$\begin{cases} \widehat{Z^{(i)[i]}_{k\%N_i}} & \text{for } N_i \le N_u \\ \sum_{l=0}^{M_{iu}-1} e^{j2\pi(\Delta_{iu}+\hat{\varepsilon}_i)l/L_u} \widehat{Z^{(i)[i]}_{k+lN_u}} & \text{for } N_i > N_u \end{cases}$$

where $\hat{\varepsilon}_i$ denotes the frequency offset for the i^{th} user;

a second gain calculator for calculating a gain from the frequency offset, for the i^{th} other user, input from the i^{th} sub frequency offset estimator according to equation below and then outputting the calculation result as a second gain:

$$e^{j\pi[\Delta_{iu}(2k/N-1/L_u)+\hat{\varepsilon}_i(1/L_i-1/L_u)]}\frac{q_i \sin(\pi\hat{\varepsilon}_i/L_i)}{L_i \sin[\pi(\Delta_{iu}+\hat{\varepsilon}_i)/L_u]}$$

where L_i denotes the number of times user symbols are repeated in a transmitter for the i^{th} user and q_i denotes an initial phase offset in an i^{th} block;

a third gain calculator for calculating a gain from the frequency offset, for the i^{th} other user, input from the i^{th} sub frequency offset estimator according to equation below and then outputting the calculation result as a third gain:

$$e^{j\pi[\Delta_{iu}(2k/N-1/L_i)]}\frac{q_i \sin(\pi\hat{\varepsilon}_i/L_i)}{L_i \sin[\pi(\Delta_{iu}+\hat{\varepsilon}_i)/L_i]}$$

where $M_{iu}=\frac{N_i}{N_u}=\frac{L_u}{L_i}$;

a fourth multiplier for multiplying the expansion result input from the signal expander and reducer by the second gain and then outputting the multiplication result;

a fifth multiplier for multiplying the reduction result input from the signal expander and reducer by the third gain and then outputting the multiplication result; and

a third selector for selecting one of the multiplication results input from the fourth and fifth multipliers in response to the comparison result input from the comparator and then outputting the selection result as the i^{th} interference.

Claim 13. (Original) The apparatus of claim 10, wherein the feedback signal generator comprises:

a sixth multiplier for multiplying the first gain input from the first gain calculator by the selection signal input from the first selector and then outputting the multiplication result; and

first through $U-1^{th}$ subtractors,

wherein the i^{th} subtractor subtracts the interferences of the first through $U-1^{th}$ interferences from which the i^{th} interference is excluded, and the multiplication result of the sixth multiplier from the reception signal for the i^{th} other user and then outputs the subtraction result as the feedback signal used in the i^{th} sub frequency offset estimator.